

# Insights from a Long-term Study of Persistent *Exxon Valdez* Oil on Katmai and Kenai Fjords National Park Shores



Gail V. Irvine

USGS Alaska Science  
Center

Daniel F. Mann

Univ of Alaska, Fairbanks

Jeffrey W. Short

JWS Consulting

Cape Douglas 2011

# Exxon Valdez Spill History

- March 24, 1989
- 10.8 million gallons of North Slope crude oil
- Spill point: Bligh Reef in NE Prince William Sound



Bob Hallinen

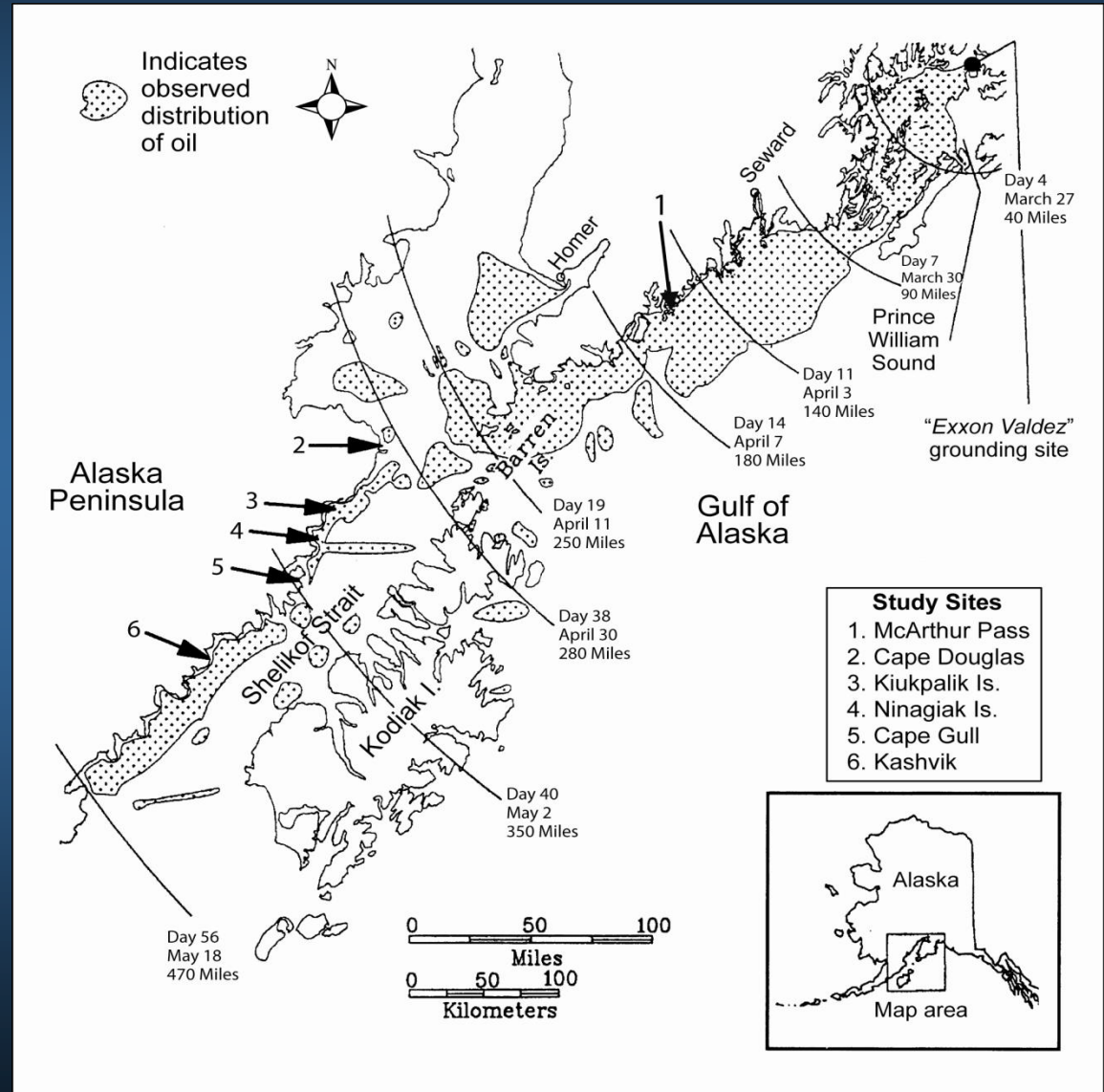


Exxon Valdez  
Trustee Council

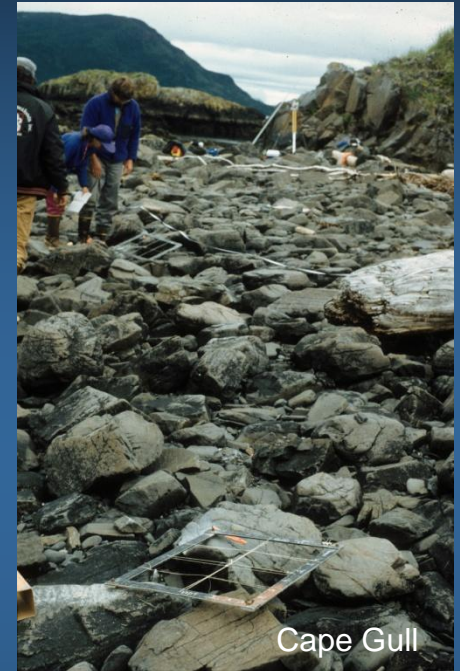


# Geographical Extent of *Exxon Valdez* Oil Spill and Study Site Locations

- Gulf of Alaska sites

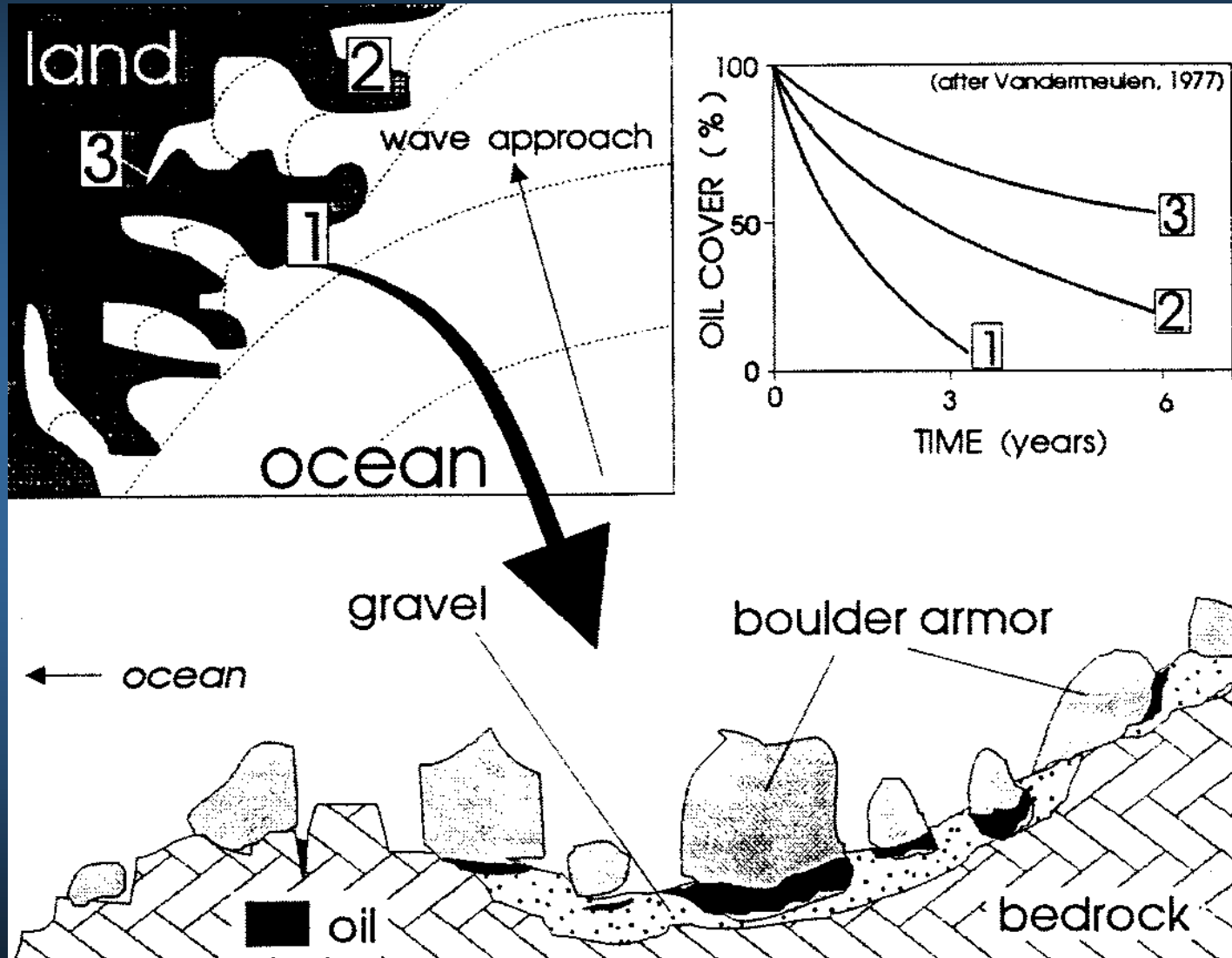


# Study Sites



- McArthur Pass
- Cape Douglas
- Kiukpalik Island
- Ninagiak Island
- Cape Gull
- Kashvik

# Boulder Armors and Oil Persistence





# Oil Mousse

---



# Objectives

---

- Monitor the persistence and degradation of oil at Gulf of Alaska beaches
- Investigate the mechanisms that allow its persistence
- 2011- Test whether oil is being released from the sites

# Study Plan Components

---

- Quantify surface oiling (quadrats)
- Subsurface oiling (dipstones)
- Oil chemistry (GC/MS)
- Boulder stability (re-survey marked boulders)
- Deploy plastic lipophilic films ('pucks')



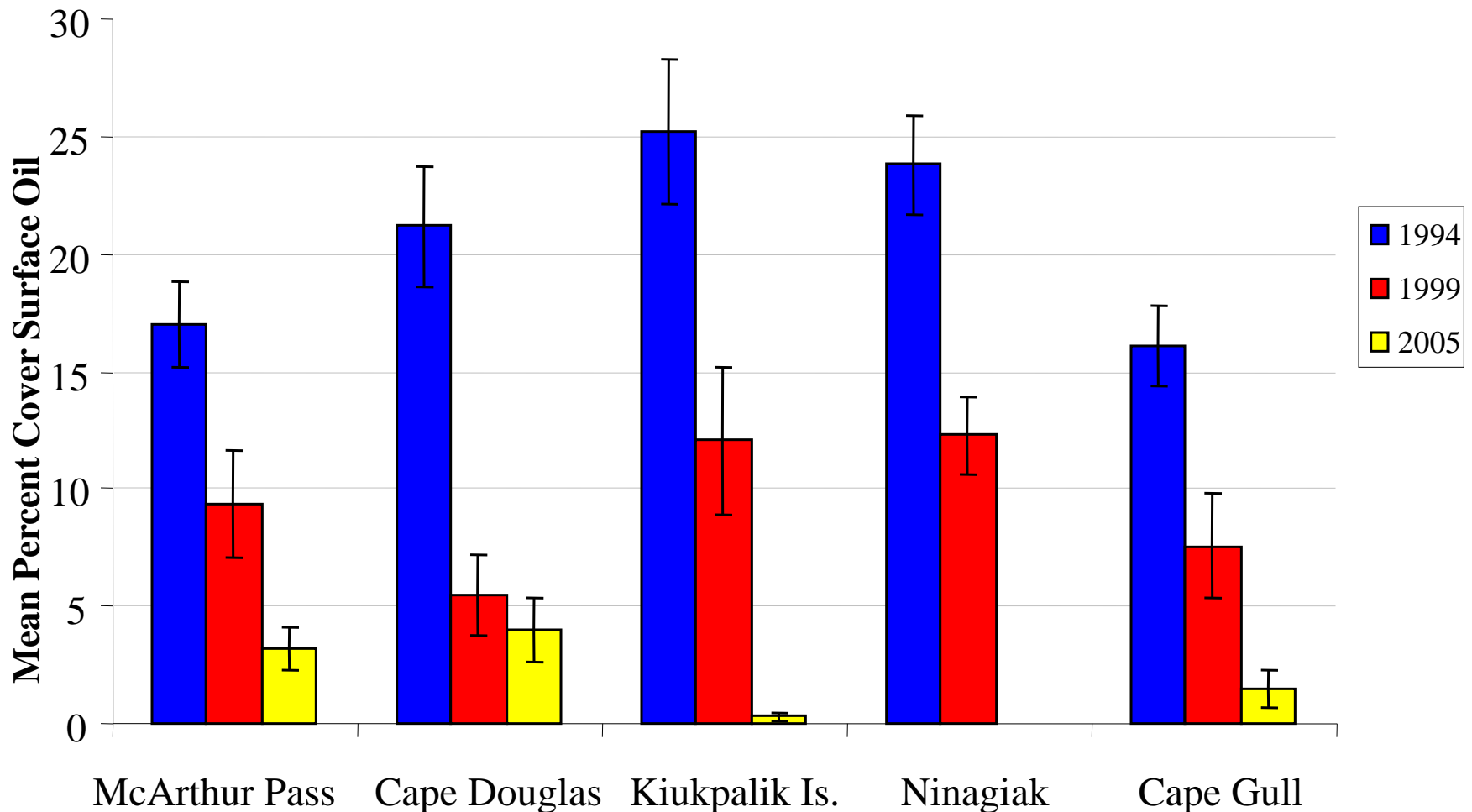
# Surface Oil

---



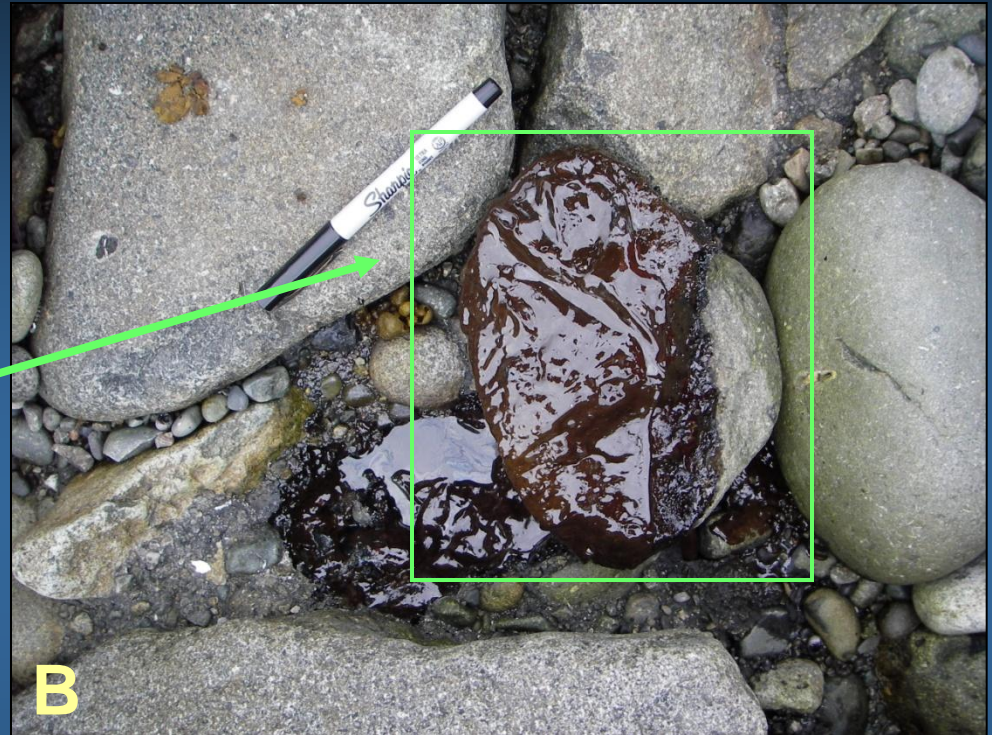
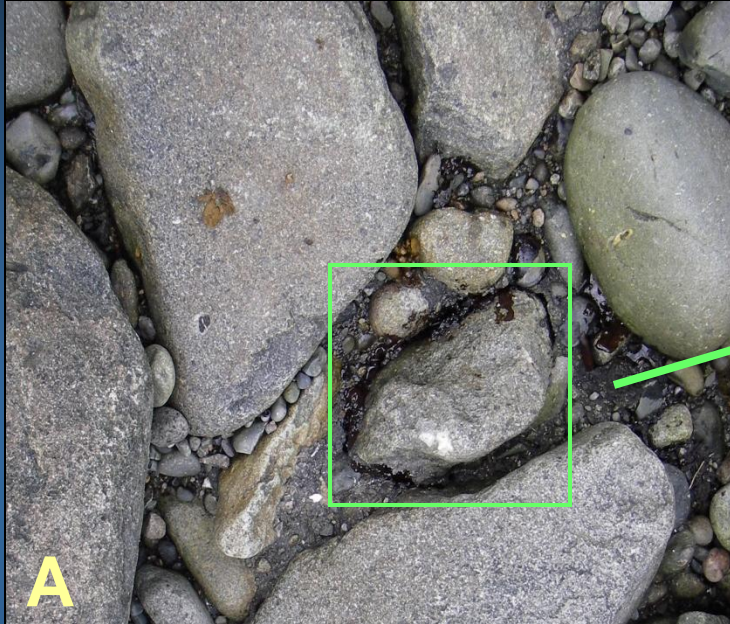
# Change in Surface Oil Cover

Mean Oil Cover in 1994, 1999 and 2005





# Dip Stones



‘A’ = reinserted dip stone; ‘B’= dislodged dip stone  
Cape Douglas, 2005



# Boulder Armor

---



Cape Douglas, 2011



## Boulder Armor

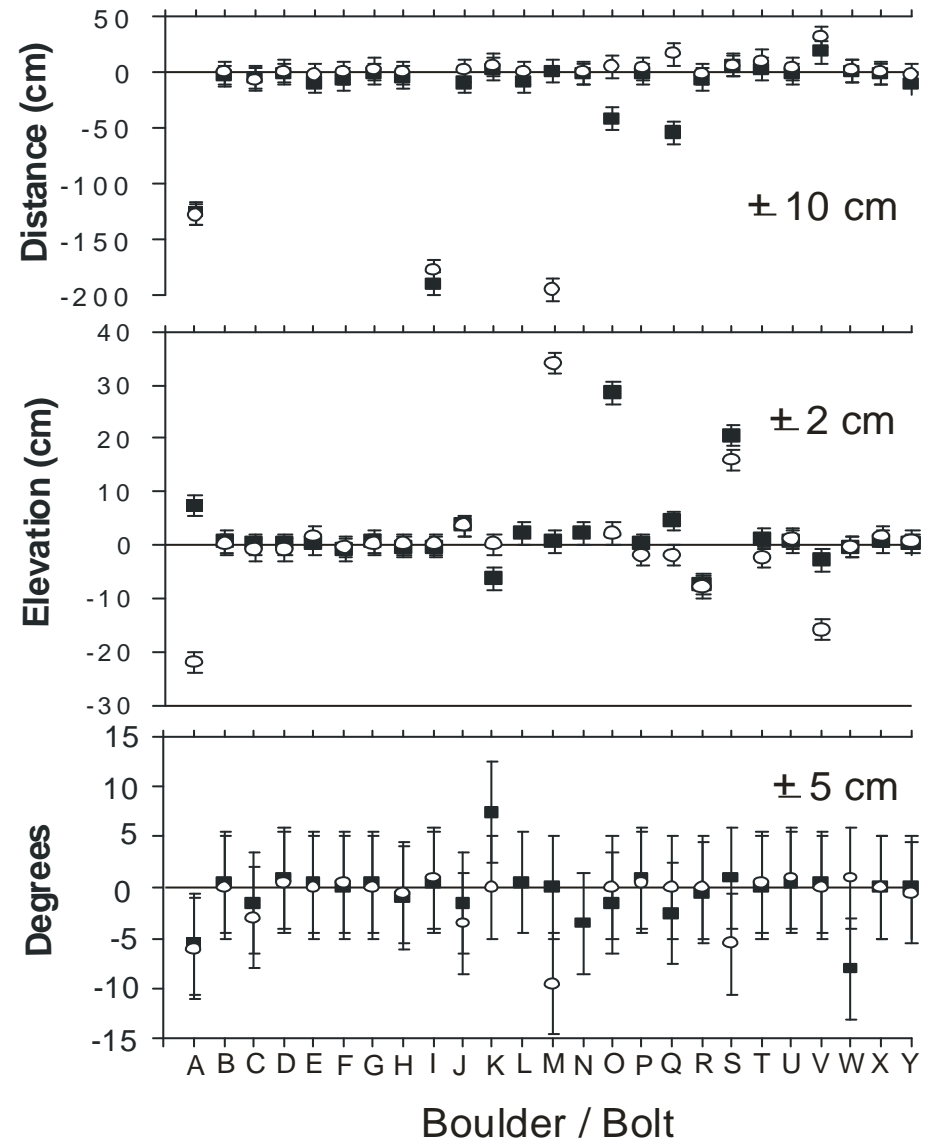


Cape Douglas, 2005

# Boulder Movement

## Cape Douglas

- Movement of bolts set in boulders
- Circles = 2005 data
- Squares = 1999 data
- Both are relative to 1994 positions





# Boulder Armors Differ





# Site or Quadrat Infilling



Ninagiak

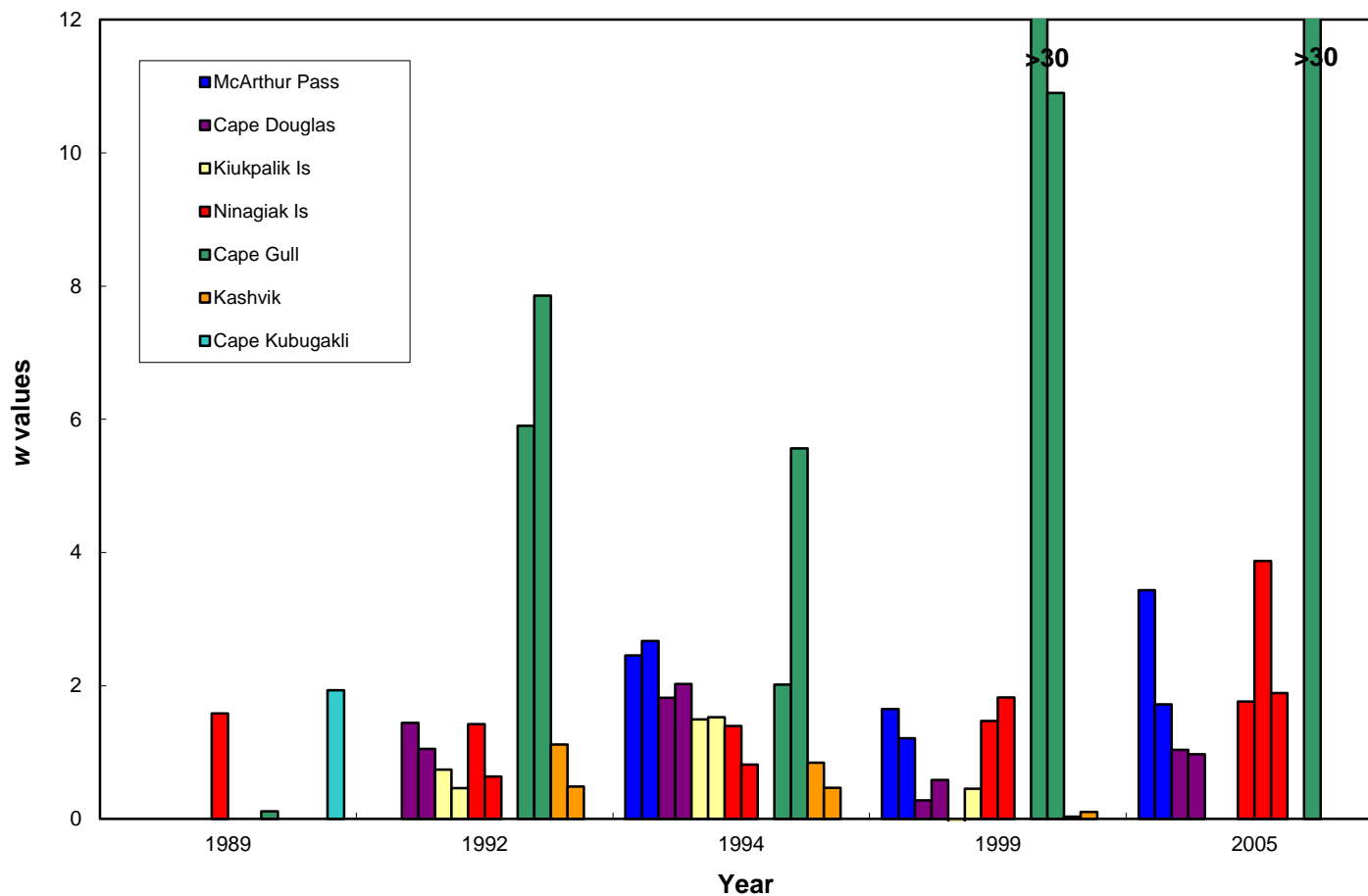


# Pertinent Oil Chemistry

---

- Polycyclic aromatic hydrocarbons -TPAHs
- Normal alkanes

# Weathering

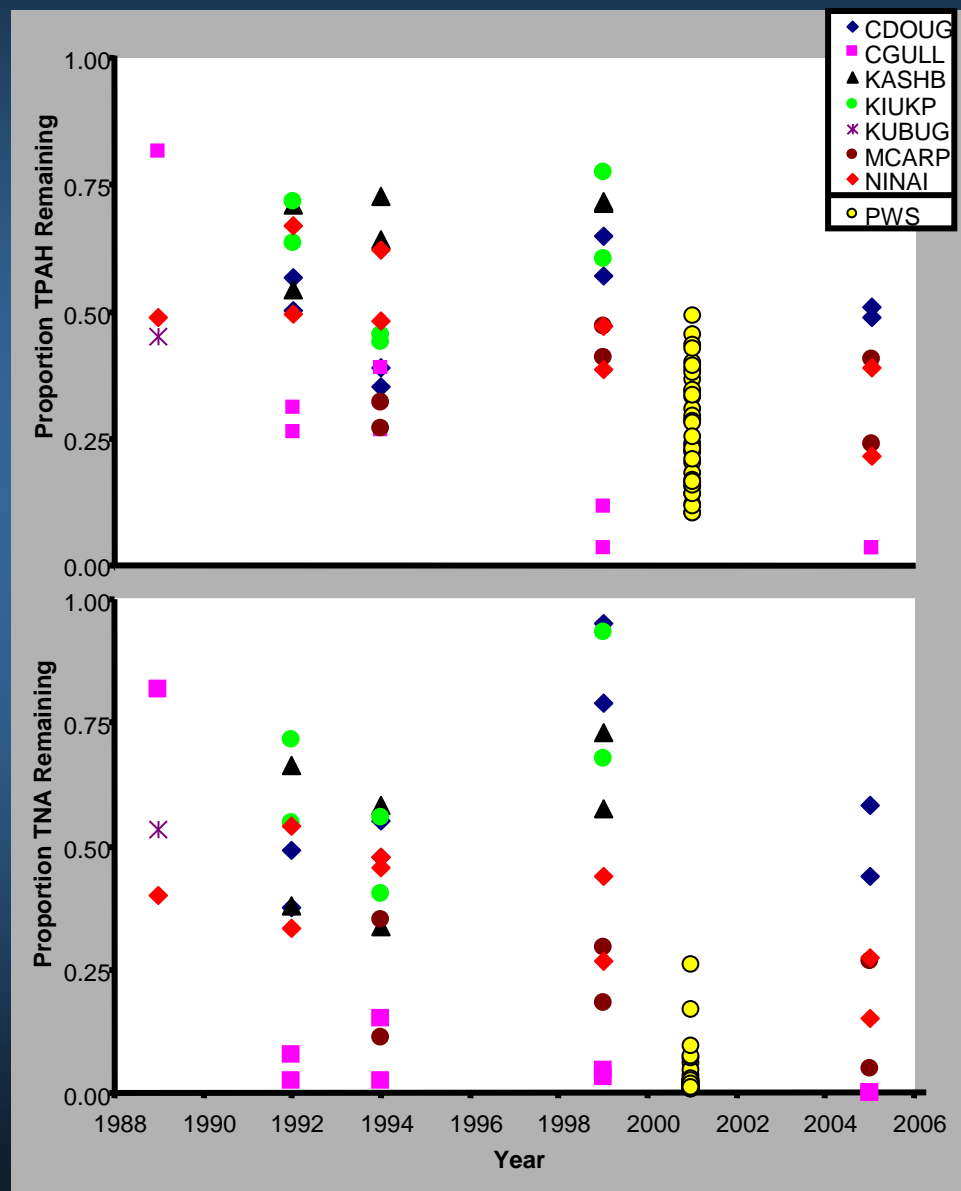


# GOA and Prince William Sound Oil Weathering

- Gulf of Alaska Beaches

TPAH

*n*-alkanes



# Leaking Oil?

---





# 2011 Images

---



# Results

---

- 16- 22 years persistence of *Exxon Valdez* oil at sites distant from spill origin
- As of 2005, surface oiling has declined significantly, but subsurface oiling has changed little
- Stability of boulder armors important in the continuing persistence of the oil
- As of 2005, oil has not weathered chemically, and remained compositionally similar to 11-day-old *Exxon Valdez* oil, at most sites
- Mousse formation allowed long-distance transport and enhanced preservation of only slightly weathered oil

# Acknowledgements

---

- Funding and support from the *Exxon Valdez* Oil Spill Trustee Council, the U.S. Geological Survey and the National Park Service
- Thanks to: Carl Schoch, Joel Cusick, Buddy Goatcher, Jennifer Mondragon, Jeff Mondragon, Erica Madison, Yvette Gillies, Sharon Kim, Marie Larsen, Jeep Rice, Mark Carls, Larry Holland, Carson Baughman, Carissa Turner, Tom Scheer, and captains and crews of the R/V Waters, Kittiwake II, and the Puk-uk







# Infilling of Quadrats



Kiukpalik: 1994

2005



# Boulder Armor











Ninagiak, 2005



# Exposure of Beaches

---

- Monitoring

# Objectives

---

- Monitor the persistence and degradation of oil at Gulf of Alaska beaches
- Investigate the mechanisms that allow its persistence
- 2011- Test whether oil is being released from the sites

